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Spring Meeting
Marine Fisheries Subcommittee

21-25 April 1997

Regional Advisory Process (RAP)
of the Maritimes Region

Mirimichi Boardroom
Gulf Fisheries Centre
Moncton, New Brunswick

June 1997

Fisheries and Oceans Science
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Table of Contents

Abstract v

Introduction 1

Environmental Overview: Gulf of Maine, Bay of Fundy, SW Scotian Shelf 1

5Zjm Cod 2

5Z+6 Cod 4

5Zjm Haddock 6

5Z+6 Haddock 8

5Z Yellowtail Flounder (USA) 10

4T-Vn (Nov.-Apr.) Cod 23

4Vn Cod (May-Oct.) 26

3PNO.4VWX Halibut 27

4T Plaice 29

4T Yellowtail Flounder 30

4T Winter Flounder 31

4T White Hake 33

Concluding Discussion 35

Appendix 1. Agenda 36

Appendix 2. List of Participants 37

Appendix 3. List of Documents 39

Appendix 4. Proceedings of the Cod, Haddock, and Flatfish Assessment Working Group 41

Appendix 5. Proceedings of Ad-Hoc Communications Working Group 47

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Abstract

These proceedings record the discussions held during the spring 1997 Regional Advisory Process (RAP) meeting addressing several groundfish management units held at the Gulf Fisheries Centre during 21-25 April 1997. The species considered were 5Z cod (Canada), 5Z cod (USA), 5Z haddock (Canada), 5Z haddock (USA), 4T cod, halibut on the Scotian Shelf and southern Grand Banks, 4T plaice, 4T yellowtail, 4T winter flounder, 4T white hake, and 4Vn cod. The proceedings outline the main points of discussion, problems areas, the analyses, and recommendations for further work. Stock Status Reports (SSRs) for the management units considered were produced and subsequently submitted to the Department of Fisheries and Oceans (DFO) in Ottawa for approval.

Résume

Le présent document rend compte des discussions ayant eu lieu durant les réunions sur plusieurs untiés de gestion du poisson de fond tenues au Centre des pêches du Golfe du 21 au 25 avril 1997, dans le cadre du Processus de consultation régional du printemps. Les espèces considérées étaient la morue de 5Z (Canada), la morue de 5Z (É.-U.), l'aiglefin de 5Z (Canada), l'aiglefin de 5Z (É.-U.), la morue de 4T, le flétan du plateau néo-écossais et du sud des Grands Bancs, la plie de 4T, la limande à queue jaune de 4T, la plie rouge de 4T, la merluche blance de 4T et la morue de 4Vn. Le rapport fait état des grands sujets débattus, des problèmes survenus dans les analyses et des recommandations pour les travaux futurs. Des rapports sur l'état des stocks des espèces considérées ont été produits et ultérieurement soumis à l'approbation des instances du ministère des Pêches et des Océans (MPO) à Ottawa.

Introduction

The meeting was opened by the Chair, Mike Sinclair, who welcomed the participants. In the introductory remarks the objectives of the meeting were reviewed and the agenda accepted (Appendix 1). The list of participants is shown in Appendix 2, and the documents that were made available during the meeting are listed in Appendix 3. The minutes of meetings of the Marine Fish Division (BIO) cod, haddock/flatfish Working Group are included in Appendix 4.

Environmental Overview: Gulf of Maine, Bay of Fundy, SW Scotian Shelf presented by Fred Page (Rapporteur: D. Swain)

Discussion

Conditions were fresher than normal. Two possible causes were suggested: increased precipitation and freshwater input upstream of the area, or less intrusion of saline deep water.

It was noted that survey data from Georges Bank for the spring of 1997 indicated that water was less saline than normal but also tended to be warmer than normal. It was noted that this is opposite to the usual tendency for warmer water to be more saline. Dr. Page responded that the 1997 observation is reliable, being based on calibrated instruments and corroborated by several sources.

The question of changes to the Gulf Stream was raised. No major changes are apparent. But not all data are yet available.

Gulf of Maine conditions are fluctuating about average levels in recent years. Data are sparse in recent years, so some extreme values are seen in these fluctuations. There are fewer data available for recent years because the U.S. data are not yet incorporated in the database.

- It was **recommended** that future analyses should include data from the recent U.S. surveys.

It was noted that the spring survey comprises a short 10 yr time series. Thus, conclusions about environmental conditions from these data only apply to the relatively short term.

The presentation of unweighted (by stratum area) data was questioned. It was indicated that these data were presented to identify any outliers, and that the weighted data were also presented.

The issue of variability in survey timing was raised. Survey timing has varied by about 20 days. This can be important on George's Bank because of the relatively shallow depths. Survey timing in 1997 was in the middle of the historical range, so the conclusions that temperatures were near normal and salinities fresher than normal are probably valid.

The general conclusion was that there was nothing anomalous about survey timing or water temperatures but that salinities were fresher than normal.

Industry representatives expressed an interest in the effect of temperature on spawning and reproduction. They indicated associations between temperature and depth and catch rates of cod, haddock and flatfish.

5Zjm Cod (Rapporteur: R. O'Boyle)

Joe Hunt made a presentation of his assessment. The content of this presentation will not be given here, as this is summarized in the relevant research document. The comments below were made during the subsequent discussion and were used in the development of the Stock Status Report.

The Fishery

The question was asked of the industry participants as to whether or not there had been any substantive changes in the fishery between 1995 and 1996. It was noted that the fishery was a by-catch to others such as haddock. The fleets would avoid cod as much as possible to keep enough by-catch to fish the other species. For instance, during June-August, cod and haddock are mixed, and fishing then would result in unacceptable by-catch of cod. The mobile gear fleet therefore avoid fishing until the fall, at which time it could cleanly fish the higher quota haddock. It was thus important for vessels to have enough of their cod allocation left for them to do this. This has resulted in a shift in the fishing seasons seen historically until later in the year.

It was asked as to whether or not the size composition of the catch had changed, to which the answer was no. For this reason, the PR used in the VPA should not change in recent year, and indeed the average for 1994-96 was used.

These followed discussion on the frequency of discarding. Did the low cod allocation result in this earlier in the year? There was no evidence of this in an analysis of observer vs port samples, although it was noted that the port technicians do not sample trips on which discarding was known to have occurred. As well, one would only see evidence of discarding through this comparison if highgrading (preferential discard of specific sized fish) occurred. It was suggested that a comparison of catch rates for observed and unobserved vessels in a particular area/season could shed light on this.

- It was **recommended** that a comparison of the catch rates on observed and unobserved vessels be undertaken to investigate potential discard patterns in the 5Zjm cod fishery.

It was noted that while DFO surveys show haddock abundance up and cod abundance down, the reverse was true from the fishermen's perspective. It was noted that past studies of this had been conducted and shown little discarding. This was corroborated by the port technicians. This was

felt to be the case historically as well. Overall, the subcommittee concluded that discarding was not a big problem in 5Zjm cod Canadian fishery.

This discussion raised the issue of the opening date of the fishery. Generally, higher and cleaner catches of haddock can be obtained earlier in the season than later. It was suggested that the June opening date be earlier than later, contrary to recent events. This requires further examination.

- It was **recommended** that the cod and haddock catch rates in 5Zjm be examined to determine the most appropriate opening date to minimize the by-catch of cod.

There was discussion on the historical misreporting of 4X cod as 5Zjm cod, but the size of this was not determined.

Mention was made of effort trends in the fishery. These are very hard to interpret due to the by-catch nature of the fishery.

- It was **recommended** that the Fisheries Management Studies Working Group continue its plan to investigate effort trends in this and other fisheries.

The catch composition of 1996 was then discussed. It was asked to compare the observed and projected catch composition for the 1996 fishery. The 1992 year-class was predicted to be 30% by numbers of the catch and was observed to be 50%. In response, it was noted that the real versus projected 1996 US landings has been used. As well, the catch at age had been updated, both of which resulted in the change in this assessment.

There was some discussion on the mixing of 4X with 5Zjm cod. Otolith and tagging studies have shown 10-15% mixing. There may also be mixing with 5Y cod. These can add uncertainty to the assessment results.

- It was **recommended** that the impact of stock mixing on this assessments be investigated. This was also highlighted at the recent national workshop on cod stock mixing.

There was comment on the commercial weights-at-age which have shown no pattern over time. Why has there not been a change with the Canadian fishery moving to the fall? It was replied that the US fishery is predominantly in the spring which may cancel out this shift in regards to any change in the weights-at-age.

<u>The Resource</u>

It was asked why the pre-1978 was not provided, to which it was replied that the data is not available.

Changes in the US survey doors and vessels have been made over the time series. These have been adjusted for. It was noted that the survey did not see the 1992 year-class until it was older.

Was there a retrospective pattern? The last analysis was two years ago and had not indicated any problem. This analysis was redone at this meeting and showed evidence for higher estimates of the 1991-94 year-classes at the younger ages now than when first estimated. It was noted that this could be due to immigration of young cod into 5Zjm from adjacent stocks, a phenomenon mentioned by the ICES Stock Assessment Working Group. This could be examined as part of the recommendation provided above.

The industry survey information was not presented as the time series is still short. Notwithstanding this,

- It was **recommended** that the age composition, catch rates and distribution of the industry survey data be provided in the next assessment.

Outlook

There was discussion on the age range in the Yield Per Recruit analysis, which should be 18 rather than the 15 used. However, the US assessment used a 10+ group, so it was decided to wait for the development of a common approach.

A stock/recruit relationship was produced which showed that recent low recruitment has been associated with low spawning stock biomass. It was noted that SSB should be above at least 30,000t as a target. This will be included in the SSR.

5Z+6 Cod (Rapporteur: R. O'Boyle)

Loretta O'Brien gave the presentation of the US assessment after which the comments below were made.

The Fishery

There was discussion on the US management measures and the effect that these have had on reducing effort. Since 1994, these have become particularly restrictive. A comparison of the Canadian and US fishery partial fishing mortalities was conducted which showed that Canadian fishing mortalities gradually increased during 1978-92 and dropped suddenly thereafter. US fishing mortalities were level over the long-term and then dropped about one year after those of Canada's consistent with the timing of the implementation of the management measures of both countries. While absolute comparisons of Fs between the two countries cannot be made due to the cod availability assumptions, these analyses show that the management measures in both countries have been effective.

The Resource

It was noted that the commercial catch rate information was provided for information only as the data for 1994/96 has not been audited. It was observed that future analyses would benefit from more spatial disaggregation, as catch rates before and after implementation of the ICJ line are considerably different.

- It was **recommended** that future CPUE analyses incorporate areas small enough to allow examination of changes within unit areas 5Zj and m, split by Canada and the US.

An examination of Z patterns in the survey data was undertaken by the Subcommittee but did not add substantially to what was presented. The Zs followed the same pattern as the Fs in the VPA although being more variable.

Differences in the ADAPT formulations of the US and Canadian assessments were noted (age range of calibration blocks) but were not considered serious.

Differences in year-class estimates between age one and two were noted but were felt to be due to survey variability. A retrospective analysis was done at the meeting and exhibited the same pattern as shown in the 5Zjm cod assessment -- systematic underestimation of the young age groups in recent years. As well, this only started to occur around the early 1990s, indicating some anomaly in the time series. This will require further investigation. The Subcommittee proceeded with the analysis as is, accepting that current year-classes may be underestimated.

It was noted that examination of the age one and two survey abundance trends was not a powerful means of deducing recruitment trends.

- It was **recommended** that a comprehensive analysis of the input data and methodological differences of the two assessments be conducted.

Some of these differences were due to gear changes. This raised discussion on the general question of future fleet composition and the impact on YPR. Generally, the PR vectors are calculated based on history and do not easily accommodate unobserved fleet mixtures. Some fleet compositions may be more desirable than others from a YPR and other points of view.

- It was **recommended** that an examination of the impact of gear changes in these two and other fisheries on the Yield Per Recruit analysis be conducted.

Management Considerations

A Stock/Recruit relationship was generated at the meeting from the VPA. It showed that the fishery is in a rebuilding strategy. The current SSB limit is 70,000t although this is based on a short time series and does not capture the full dynamics of the resource. Overall, the resource appears to be gradually declining and the future is not certain.

There appeared to be a large decline in the historical biomass of the resource. An examination of the split of the SSB (age 3+) between 5Z and 5Zjm was conducted. This showed that the ratio of 5Zjm cod SSB to that in 5Z, calculated form the US and Canadian VPAs, was stable at around 40% until about 1993 at which time it fluctuated greatly. This could be due to estimation problems for the observations in the recent years and thus the last two years were dropped from the analysis.

5Zjm Haddock (Rapporteur: D. Rivard)

Stock Status

The assessment uses 3 indices of abundance: USA fall survey (since 1963), USA spring survey (since 1968) and the Canadian spring survey (since 1986). The biomass has been increasing since 1993, due principally to the 1992 year-class but also to the 1991 and 1993 year-classes. Exploitation rates have reached a peak in early 1990s, but have been below the $F_{0.1}$ target in 1995 and 1996.

Catch Information

It was noted that the estimates of discards by the USA were included in the catch at age. With respect to the use of catch rates, it was noted that the degree to which haddock is also a by-catch fishery can influence the catch rates and prevent using them as indices of abundance. It was noted that a portion of the cod and haddock quotas is used as a 'tolerance' in order to prosecute the flatfish and pollock fisheries. There is no evidence of discarding in the Canadian catch: the at-sea and port sampling gave similar length profiles. A fishery representative noted that the fishery on haddock discard had not been an issue in recent years.

- It was **recommended** that the Fisheries Management Working Group be mandated to examine other sources of information for evidence of discards, e.g. surveillance data. This should be done in the context of the multi-species nature of the fishery (cod, haddock, pollock).

The changes in mean weight at age led to a discussion on how they were calculated. An industry representative expressed concern that the mean weights could be affected by the seasons (e.g. due to roe content) and suggested that samples be taken from commercial fisheries in a routine manner. The utility of getting maturity and weight information from commercial fisheries which operate on mature aggregations was discussed. It was noted that such samples may not be representative of the entire population. From a sampling standpoint, there was no reason to ignore the decline in mean weight at age for the recent years and it was agreed that these changes should be reflected in the catch projects.

Abundance Indices

It was noted that the 1963 year-class disappeared relatively quickly from the surveys after age 6. The expected increase in the survey index as this year-class moved through did not occur as should have been expected from such a large year-class. It was noted that the landings were very high when the 1963 cohort recruited to the fishery and that this cohort had probably been depleted due to high exploitation. It was concluded that there was no doubt that this year-class was big but that its survival had been low because of high Fs.

Recruitment

A discussion took place on the mechanisms that could lead to the observed recruitment patterns for haddock which appear to be very variable between years. It was noted that there could be different reasons for production of a good year-class in certain years. The year-classes are probably determined by environmental processes affecting the survival of larvae and young fish of these fish. Water temperature, food distribution, strength and extent of upwelling, advection off the banks were seen as important factors in the determination of year-class strength. It was noted that the number of years between the years of recruitment was variable and, consequently, that the recruitment level was difficult to predict. However, it was also noted that the recent years showed a pattern that was quite different than that from earlier years. For instance, in the 1930s and 1940s when the stock spawning biomass was much higher, recruitment had been steadier.

Concern was expressed with the lack of coverage of deeper water in the Canadian spring survey. It was explained that this survey was designed to avoid areas where the distribution of haddock is sporadic. Survey catches in the spring were very sporadic or variable in the deeper water of the northeast peak. It was observed that the US spring and fall surveys both go to deeper waters and did not find high concentration of haddock in deeper waters in recent years. A fishermen indicated that there are no haddock in the deep water portion of the northeast peak in the spring. It was noted that the US fall survey does cover the deeper areas of the bank, in fact up to Browns, and that the lack of samples from the deeper portion of the northeast peak in the spring was not an issue for this assessment.

ADAPT

The ADAPT formulation used was investigated for evidence of retrospective patterns. No evidence of a pattern could be found. It was noted that different age groups were used in the Canadian and US assessments because fewer zeros at older ages for 5Z as a whole in comparison to 5Zj.m. The estimates were consistent with those produced last year. There was a small difference in the estimates of recent year-classes, those from this year's assessment being somewhat lower. It was noted that the major differences in the projections were mainly due to the changes in mean weight at age.

With respect to management measures, it was noted that there is a greater chance of having an increase in biomass with status quo TAC or a fishing target level lower than $F_{0.1}$. There is no

evidence of important year-classes are going to provide any relief in the near future. A discussion took place on the strategy to adopt in view of very depressed abundance. In that context, it was noted that the historical perspective provided by the 1931-1951 reconstruction of the biomass was a good way to put recent improvement in biomass in an historical context.

- It was **recommended** that the reconstruction of the biomass for the missing years (1950s and 1960s) would provide insight on the stock dynamics in this period and allow to put recent changes in abundance in perspective.

The desirability of avoiding SSB levels that increase the probability of poor recruitment was discussed. That alone may be a reason t move towards higher SSBs. In that context, a status quo F for this stock in 1997 might be a better rebuilding strategy than $F_{0.1}$. It was also noted that there had been many new measures introduced for the conservation of this stock in recent years and that it was important to continue to enroll the support of the industry in developing a strategy that will work. How much quicker will recovery with closure vs $F_{0.1}$. Simulations done by USA suggest that $F_{0.2}$ or half $F_{0.1}$ are reasonable ways to go.

5Z+6 Haddock (Rapporteur: D. Rivard)

Stock Status

Stock is at a low level and fishing mortality has been reduced in 1996 to below $F_{0.1}$. The SSB was of the order of 150,000t in the early 1960s. It declined to about 20,000t in early 1970s, recovered to about 70,000t in early 1980s but declined to 15,000t until 1993. Some increase since, as the 1992 year-class recruits. The SSB has increased from the record low level in 1992, due primarily to the conservation of the 1992 year-class. However, the 1992 year-class, thought it appears large in relation to recent recruitment, is still only one-third of the average recruitment expected from a rebuild stock. Indications are that the year-classes following the 1992 year-class are relatively weak.

Discussion

Changes in US management in recent years were noted, including reductions in days-at-sea, area closures (Area 1, 2 and Nantucket Lightship Area), trip limits (500-1000 lbs/ trip), and mesh restrictions (6 inches). Discards increased since 1994 with introduction of trip limits. For instance, individual trips discarding 5,000 lbs to 25,000 lbs of haddock were common. In 1995, year round closures were introduced and resulted in reduced access to the haddock resource for US fishermen. In 1995 and 1996, much lower levels of discards were observed. USA discards accounted for 16.1% of fishery removals in 1994, 5.2% in 1995 and 7.6% in 1996. About 75% of discards by number and 90% by weight were legal size fish. Estimates of discard were included in both the Canadian and the USA assessment.

With the relaxation of trip limits, it will be important to continue to monitor the age composition and to evaluate the amount of discard. Despite trip limit, an industry representative indicated that the price differential between scrod and large fish could continue to be an incentive for discarding. Increasing the trip limits would force others that avoided the areas of high concentration of small fish to go there -- as a result, this may have an overall effect of not reducing highgrading and discarding.

Effort

There was a shift of effort from eastern portion to western portion since 1994. Prior to 1994, a large portion of landings came from eastern portion. This move appears to be partly related to area closures.

Sampling

It was noted that the age composition of US catch is skewed towards older age-classes in comparison to that of the Canadian landings. This could be related to discarding and retention of larger fish by the US fleet.

The impact of the buy-out program for US vessels were discussed. It was noted that the pilot program was experimental and involved 13 vessels. The main program, which is now in progress, could involve about 75 vessels. It is too early to evaluate the impact that this program will have an effort reduction.

It was pointed out that there has been a shift in distribution of haddock around 1980. In recent years, haddock concentrated mostly on the northeast peak.

Survey Indices

Three indices were used in the ADAPT formulation -- US fall, US spring, and Canadian spring. In 1995 and 1996, the highest abundance was observed in Canadian waters in 1994 and 1995. In 1996, there was some indication of haddock aggregations in the closed areas (areas 1 and 2) in the US spring survey. In particular, one large tow was obtained from closed Area 1 caused some problems in ADAPT tuning. A grid survey of closed areas confirmed the occurrence of a large concentration of haddock in the closed area in 1996. It was concluded that there is some evidence of recovery in that area.

All sets were included in the analyses, rather than eliminating one set arbitrarily. It was noted that the result of the 1997 spring survey are not available because the survey is still out. However, preliminary information from that survey indicates that the is another large tow in Area 1. Various options to account for large sets in survey were discussed, e.g. weighting by inverse of variance of survey estimates or shrinkage (as suggested by some ICES Working Groups in this case) could be used. It was agreed that such options need to be explored further.

Some were concerned that leaving the high survey set could lead to an overestimation of the biomass. It was pointed out that removing it does not capture reality either, mainly in view of the fact that another large set was found in the 1997 spring survey which is still being pursued.

It was also suggested to verify if the index shows similar trends inside and outside the closed areas. It not, the stock outside the closed areas remain lower than in the closed areas, we could be exerting a higher F outside closed areas and overexploit this portion of the population.

ADAPT

The model showed strong positive residuals for the USA spring survey in 1996. The effect of the large tow in 1996 was investigated through a sensitivity analysis. Eliminating this tow resulted in a much lower mean number per tow for that year and made the residuals of the ADAPT formulation more consistent with previous years. The rationale for eliminating or downweighting the survey index for one year was debated.

- It was **recommended** to reconstruct longer time series of biomass and recruitment, as was done in the Canadian assessment (1931 onwards). This would allow to put recent trends in biomass in perspective.

Stock Recruitment Relationship

Age 2 against SSB was used. The S/R relationship was discussed in the context of the definition of thresholds for SSB. It was noted that the USA threshold for SSB has been set at 80,000t. The SSB is currently at 30,000t. USA scientists indicated that a 10-year projection for SSB will be made to determine the likelihood of reaching the threshold under various scenarios. It was noted that defining recruitment trajectories for such projections is a complex issue and is being investigated.

Comparison of Canadian and USA Assessments

A comparison of the results of both assessments will be included in the Stock Status Report. Both assessments are very consistent and differences could be explained by differences in the distribution of the resource, or the dynamics of the USA and Canadian fisheries.

5Z Yellowtail Flounder - USA Assessment (Rapporteur: J. Rice)

The first presentation was presented by Steve Cadrin.

It noted that:

- Catches in the USA dominated until the early 1990s, when Canadian fisher was developed.

- USA sampling level is low due to low landings, so accuracy of catch at age is becoming questionable.

- Discard estimates have been developed recently (1994 onwards) from logbooks and observer data. Then stratified the values from the two sources are not significantly different. With more logbook data, get more robust estimates of discard ratios by gear and 1/2 year. Trawl discards are declining slightly; whereas dredge discards are higher and may be going up. Some of the dredge discards may be regulatory in the scallop fishery.

- Due to low landings of age 1, the discard estimates of these ages are very suspect (poorly determined denominator in the estimation algorithm).

- Survey index -- Fall survey in 1995 decreased, but in spring 1996 increased sharply. This had big effect on assessment, and is largely a consequent of 1 large set.

- Size and age composition of fishery - Spring survey composition has some patterns like catch: there is a predominance of age 4 but some increase in representation of adjacent ages as well. In the Canadian survey, most fish from the same size range are classed as age 3, so there is some unresolved problem with age-length conversions.

- Scallop survey data looked into the aggregate abundance as well; some similarities, some difference.

SPA

- In the analyses most of the surveys showed some coincidence with numbers at age. Moderate to good match of logged estimates from surveys, improving to age 4 and then declining. All surveys except Canadian age 1 are included in calibration block.

- There are some patterns to residuals -- trends and 2 outliers, and patterns of correlated errors (all residuals with same sign in a given year). Could not be resolved in the USA Committee.

- The average F was around 1.4 for most of the time series, but dropped by half in 1994.

- Year-classes show high contrast; moderate 1990-94; last 2 are very weak. Strong year-class in late 1970s led to increase in SSB, but declined in early 1980s.

- The assessment indicates the stock may have been 50,000t some years earlier.

- All large year-classes were produced with SSB greater than 8,000; when SSB was about 10,000t tendency for strong year-classes increased.

- Bootstrapped estimates of bias are stable after 200 bootstrap runs; magnitude of bias is 7% (age 1), 3% (age 2), or 1% (age 3 plus).

- The projections were with a bootstrap distribution of some parameters, and produced at least squares estimate indicated a low P and F exceeding target of 0.1; SSB median of 11,000t, with 28% chance of being below target of 10,000t.

- A retrospective analysis indicated the population at age 1 or 3 was estimated badly in 1990 and 1992 assessments; however, the Fs and SSB estimates consistent.

- Projection - at $F_{0.1}$, landings are likely to increase in the short term, and the SSB increased about both $F_{0.1}$ and status quo F in 1996.

Discussion on USA presentation:

Questions (Q) (M. Sinclair) - Considering the split USA and Canadian fisheries after 1993, when the Canadian fishery landed more than USA, where are the USA fishing.

Answer (A) - IN 1996 much fishing was just outside closed Area 2.

Q - Any evidence from surveys to suggest shift in distribution of yellowtail.

A - It is hard to see any patterns in centres of distribution in USA survey, but Canadian survey has a denser allocation of stations, and does show pattern more.

The second presentation was presented by John Neilson.

The research document and stock status report were both introduced.

Points mentioned included:

- The bottom line of the assessment is that 2 different methods were used to estimate abundance, and both gave comparable results.

- Recent Fs are below F0.1 but the stock is still in depressed stage.

- Management unit is Zjmnh.

- There was a new directed Canadian fishery (1993), with TAC of 630t and landings of 470t.

- Compared to the Canadian assessment last year, USA estimates of discards and landings are both revised.

- Canadian fishery - m contributed largest percentage of landing, not j.

- In 5Zm the catches cluster around the yellowtail 'hole'.

- The fishery was dominated by tonnage class (TC) 3 trawlers, with regulatory discards in scallop dredges. Otherwise discarding was minimal.

- The catch length compositions show a regular progression of sizes.

- In 1994 there were comparatively high catches. Comparisons of length sampling vs IOP observers is major source of discard estimate.

- Last year there was more discarding, but 1996 very little. Fishers claim discarding is NOT a problem.

- There are problems of interpretation of length frequencies.

- There was no opportunity for industry based surveys because at least in 1995 and 1996 most fishing is in small area; the exception in 1994, when fishing was more widespread.

- Gillnet catch rates are thought to be going up, as are all the survey indices.

- Landings at age and length - Tried to do sex disaggregated catch at age. Done for 1993-1996. There were problems with a minimal number of age determinations.

- Overall age composition only changed in last year. There was a relatively stable age distribution with ages 3 and 4, which did not match expectation of increasing age classes with declining fishing mortality.

- The length at age has increased for ages 3 but there are inconsistencies which have not been resolved about the age-length relationships.

Abundance Indices

- The Canadian spring surveys increased from 1995 to 1996, and there was a bigger jump from 1996 to 1997.

- The USA spring survey shows generally the same patterns but not as marked.

- The USA fall survey is the longest series. From 1963 to 1977 the index shows a big collapse, and since then there has been little pattern.

- If the Canadian survey is scaled to the USA spring survey, the Canadian survey in 1996 is not out of range of USA values from 1960s. This is the effect of many large sets, not just one or two. The 1997 survey found high abundance in areas of high abundance in past years, and increasing abundance in new areas.

- Comparing the USA spring survey from 1971-73 vs more recent surveys, the resource was more widely distributed in early 1970s, but there are also some similarities in distribution as well. The USA surveys both have a low level of sampling in the area where Canadian spring survey finds the most fish.

- Regarding the length composition for last 3 years, 1997 has a broader length composition in both males and females, and a hint of recruitment in 1995 year-class.

- The percent of biomass in Canadian zone is highly variable interannually from USA surveys, but less so from Canadian surveys.

- With regard to analytical approach to determining stock status, Canada used ASPIC, whereas the USA used ADAPT. Canada used an age aggregated methods, because of concerns about the ageing accuracy. ASPIC allows multipleindices; rolls up all biology into two parameters; r and K. It is a version of a surplus production model.

- The inputs were: Spring Canadian survey 1986-96 (not 1997); USA spring survey 1968-96; USA fall survey 1963 to 1996. To diminish effects of initial conditions, results are presented leaving out initial 5 years.

- Bootstrap was done with 500 trials, and biomass projection for F0.1.

- Fit to USA fall survey is good except for some earlier years.

- Fit to USA spring survey is not quite as good.

- Fit to Canadian spring survey is quite good.

- The VPA and surplus production models give pretty similar pictures; there was a trough beginning about 1984, recovery started in 1990, and accelerated in last 2 years.

- Estimates of exploitation rates are about the same for both models -- 50% in 1980s, 40% in early 1990s, now down to 15%.

- Biomass at MSY from surplus production model is 38,000t which is higher than target from USA assessment.

- A tale of projections in the SSR was reviewed.

<u>Discussion</u>

THE FISHERY

Q (Gilbert) - Why can't scales or otoliths be aged?

A - We wanted to evaluate both, and have not started formal program due to resource limitations.

Comment from Industry: Vessels operators say this is the easiest fishery in the world; loads of fish, no searching. There is some highgrading, but this is the exception, not the rule, and not considerable amounts. In 1994 may have had a significant amount of discarding from some players, but now size of fish gone up and problem has nearly gone away. New year-class in survey (25 cm) has not shown up in fishery using 155mm square mesh.

Q (Frank FRCC) - You are showing 12,000t landed, but total biomass was 15,000t. Did we catch them all. John Neilson explained figures in the text more fully.

Q - The selectivity of gears should be in the research documents, because this is important to effectiveness of management.

A - USA has same flexibility and is choosing square not diamond mesh at 155mm.

Comment (Mike Sinclair) - The key uncertainty is age compositions, especially spring and fall surveys.

Reply (Steve) - The problem with age is one thing, but there is also concern about the size composition from different surveys and fisheries. Cannot tell if it is geographic patterns for the age 4 cohort, because Canadian samples do not go back far enough in time. All we know is age 4s are not as common as expected. In calibration the age 5 cohort should dominate, and is largest at age 5 since 1970s.

Q (Alan Sinclair) - Regarding geographic distribution of USA effort, has stock structure been looked at?

A (Steve) - Lux looked at it in 1960s. Just to west of area is southern northeast stock. Tagging shows it rarely crosses across South Channel, and there is even less exchange with Cape Cod stock. There is similar recruitment patterns between southern New England and Georges bank, but SSB trends also comparable, so that may not be mixing of spawning products. Also Cape Cod has had some recruitment events recently which have not shown up on Georges. The USA fishery in 1994 and 1995 was along south and west borders of the bank, whereas the Canadian fishery was on the northeast slope.

Comment (Mike Sinclair) - When people looked before, models suggested there was mixing of at least larvae on the whole bank. However, adults may be like scallops, in that seeding is global but there is little movement once settled.

Q (SG) - Where are the data on larval distribution data from?

A (Mike Sinclair) - There may be just models based on physics, and no yellowtail larval data. There is a reference somewhere. Maybe Marmap atlas has the right information.

Q (Alan Sinclair) - If you applied same principles of physics to cod and haddock , what would happen?

A (SG) - We have not drawn any conclusions about whether the two spawning components would have products which would mix.

Comment (Steve) - Yellowtail are not like gadoids. You do not see spawning aggregations, rather widespread spawning in spring.

Comment (Alan) - Based on what happens in Gulf, there may be finer stock structure here as well.

Comment (Industry) - Spawning and distribution are widespread and depends on bottom type.

Comment (Steve) - There is lots of fidelity to depth zone, but no discontinuities of spawning sites within zone.

Comment (Mike Sinclair) - The reason Canada did not separate out j+m is that it was thought to be on the fringe of a larger stock. Maybe we would do better viewing this as a scallop in distribution ? (speculation)

Comment (Frank) - Restress it is habitat (35-45 fathoms on sandy bottom, not elsewhere) that determines distribution.

Q (Bob O'Boyle) - How was the size at age by sex handled.

A (JN) - It was somewhat different in the two assessments, but did not make a difference to results. Based on difference in size composition, we expected to see difference in age composition as well. The fact that there was not a difference is disturbing.

Q (SG) - Regarding catch rates there is a decline over the season in Canadian catch rates. Is that seasonal change in q or localized depletions?

A (Industry) - Because the change is very late in the year, it could be weather effects or changes in who participated in the fishery.

A (Steve) - The change from spring to fall could be local depletion.

Comment (SG) - Neither cause is consistent with assessment which is finding stock to be increasing.

Comment (Mike Sinclair) - The conclusion is that we observe a seasonal decline in catch rates but do not have an explanation.

SURVEYS

Q (Mike Sinclair) - Why was the 1997 Canadian survey point excluded?

A (JN) - It was excluded because catch at length suggested numbers increased in older ages more than one would expect, so there may have been a change in q. Also, the USA spring survey was not finding the same big increase.

Comment (Mike Sinclair) - The logic may appear inconsistent with the argument for haddock. There, however, we are leaving out a whole series and not just one point.

A (JN) - We will have to do something about effect of the 1997 survey on the surplus production analysis; but at this time it cannot be used in age structured ADAPT.

Comment (SG) - the production analysis will estimate average growth rate of the population over the whole period, so the 1997 point should not have a lot of impact.

Comment (Steve) - The 1997 USA springs survey data are not ready, so the USA index could not be followed.

- **Action:** the surplus production model be done with the 1997 survey point in, as well as excluded, to see effect of the point.

Q (Bob O'Boyle) - In Figure 11, why is the USA combined index not between Canadian male and females?

A (Steve) - Because of differences in size composition of US and Canadian catches, the Canadian combined index should be between Canadian male and female, but the US combined index does not have to be.

Q (Fred Page) - Why is there an increase from 1995 to 1996 in Figure 11a.

A (JN) - This is the concern that makes us not want to sue the aged material from 1997 at this time.

Comment (Steve) - There is some corroboration of increased biomass in both USA fall survey 1996 and Canadian spring 1997; just not the same magnitude.

Summary (Mike Sinclair) - All the surveys show the decline has been completed and recovery is underway. There is no change in distribution within surveys, but some indication of improved recruitment. The catch rate series follows the surveys.

Summary (Mike Sinclair) - From the ADAPT run there is a reasonable fit, especially to ages 3 to 5.

Comment (Steve) - there are some year effects and a could of outliers, but pretty the estimates are stable to bootstrapping; not much bias or large CVs for the outliers. It may be appropriate to leave 1995 point out of stock-recruit runs.

Q (Mike Sinclair) - Given the possibly serious aging problems, would you expect ADAPT to give anything useful.

A (JN) - The problem may not be an ageing problem, may be sampling problem.

Comment (Mike Sinclair) - The point is that results of ADAPT suggest the age problem is not all that serious.

Q (Mike Sinclair) - The ASPIC production model used 3 of the 4 surveys indices used by ADAPT. Why do you get such different projections from same starting points.

A (JN) - The r estimated for the whole time series is more optimistic that the VPA estimate of population growth at its present size and age composition.

Q (Denis) - In the ASPIC run you have constrained key parameters. In ADAPT you remove the constraints at the end to see if you are at the optimum. Have you done that for ASPIC.

A (JN) - The author of the package searched parameter space for us and found the best parameters. Then the model was run without constraints, and produced similar estimates with higher variance, but does not wander too far.

Q (Mike Sinclair) - Are we accepting the ASPIC model?

A (Group) - Yes, we take some comfort from the VPA similarities, but note divergence from 1976 backwards.

Comment (Steve) - The one-way trip of the stock downward prior to mid 1970s does not give us enough ability to control the trajectory of the reconstruction.

Comment (Alan Sinclair) - The ADAPT and ASPIC trajectories may be further apart in absolute scale in the 1970s, but percentage difference may be constant.

Q (Alan Sinclair) - What are key diagnostics of ASPIC?

A (SG) - According to residuals in the plots these are among the best of fits seen for this model. The observed-predicted (pg 15+) residuals are quite small and do not show the serial correlation which is common in ASPIC. The fit to CPUE is quite good (pg 21+) without the lags which are common in these fits to large pelagics. The autocorrelation in residuals mean your degrees of freedom are less than the number of observations, so the variance is underestimated.

Comment (AS) - The tendency for positive residuals is present, and this may mean we are in error.

Comment (Bob Mohn) - We cannot accept the model when only 2 of 20 people have seen it before.

Comment (DR and SG) - It is only another version of surplus production model, and we have seen them in many other places such as Gulf redfish.

Comment (Steve) - The Working Group felt the two methods complemented each other, and could not prefer one over the other.

Comment (Bob Mohn) - There is no objective function in text, nor other information about the algorithms used. Cannot accept without more information.

- **Action**: Assessment authors will prepare a 1 page Appendix with more information on the model by Friday.

Comment (SG) - On pages 14, 16 and 18 are values minimized in the objective function.

Summary (Mike Sinclair) - If we assume the production model will be accepted with the 1 page annex, and the model has been run with 1997 point, then we will be in position to say something about stock status, projections, etc. We have projections with ADAPT and ASPIC. Which should be use?

Comment (Alan Sinclair) - Figure 22 gives B msy over 35,000t. What target and limit reference points should be have? The international agreements say fishing should be curtailed when B is below B msy. It should be possible to lower F to near zero, to get growth up to B msy.

Comment (Industry) - Why should we go to B msy when biomass cannot get bigger?

A (Steve) - The biomass can get much bigger than B msy. And the USA 10,000t was negotiated at management level, so it is not completely biologically based as a target.

Comment (Ralph) - The 10,000t target was not based on stock-recruitment function, it was the point below which poor recruitment was more likely. That was not the result of major over-riding analysis, but definitely a minimum threshold which we unquestionably want to get above.

Comment (Mike Sinclair) - Industry should be reassured we are not looking at closing this fishery down completely.

Comment (Industry) - This is one fishery were are confident can be conducted at a F below F0.1.

Q (Mike Sinclair) - In doing projections, do we use output of VPA model as start for 1997?

A (SG) - We have no basis for discounting either model. The surplus production model is more optimistic, and we know the VPA is projecting low because it assumes incoming recruitment is weak. In fact we have some suggestions recruitment may not be weak. There is no objective reason to choose one over the other. If current values of weight at age and partial recruitment are carried over into projection, then results are not all that different. I suggest we present results of each model in the SSR, and explain them with the various caveats.

A (Steve) - The USA choose the ADAPT model partly on terminal estimates of recruitment, and I agree the estimates may not be too reliable. however, surplus production assumes long-term average r, and we know we do not have any dominant year-classes coming in (which have influenced the global r) so the global r is optimistic.

Comment (SG) - Those complexities are why we present both and explain the complexities, not just choose one.

Q (Bob O'Boyle) - The scallop survey index is the most optimistic, and it is not in the ASPIC run. Would VPA look more like the production model if that index was not used?

A (Steve) - It would make them more dissimilar.

Comment (SG and Others) - The discrepancy between table in the Outlook and Figure 22 in 1997 biomass needs to be checked and corrected or accounted for.

Comment (DR) - 1997 is a cross-over year for the two models, because ASPIC r is pulling up stock with growth which is higher than is present in VPA.

Comment (Alan Sinclair) - The Committee needs to see run results from which the Outlook table was calculated.

- **Action**: Those runs will be tabled.

Comment (Mike Sinclair) - If we take proposal to present multiple model F options, then should we be saying something about the depressed nature of the stock, and rebuilding objectives?

A (Alan Sinclair) - Both models say the stock is low relative to history, and relative to B msy. F0.1 is not a good rebuilding target F.

Q (Mike Sinclair) - Uncertainties increase in production model as it goes bank in time. Does this make the estimate of B msy highly uncertain?

A - There were arguments on both sides of this questions, and no clear resolution.

Q (Mike Sinclair) - Are there any other signposts which can tell us what the stock used to look like?

A (Steve) - There have been several historical attempts, but none were accepted for various reasons.

Q (Mike Sinclair) - Is the USA fall survey telling us 35-40,000t was realistic in 1960s?

A (Steve) - There is an index from the survey, but it is extremely noisy and weight per tow, and not minimum trawlable biomass.

A (SG) - It was those values for the weight per tow which went into production model, and then given a survey q, it is possible to work back to biomass in 1960s of around 50,000t.

Comment (Mike Sinclair) - Here we have only a few data points from earlier time.

Comment (Steve) - We have landings back to 1930s, but there is no period of stable catches. the fishery was a pulse from 1960 onward.

Comment (Bob O'Boyle) - The F table suggests that F has been really high for a long time.

Comment (Steve) - This means the estimate of r assumes a long term resilience to the stock. Do we believe that?

Comment (Alan Sinclair) - If Canada decides to live up to new agreements, we have to implement these rebuilding approaches.

Q (Mike Sinclair) - Is this value the one we want to use for B msy?

A (Group) - Yes it seems, we will accept it as a provisional estimate until we have something else.

Comment (Russell) - These is cause to be uncomfortable specifying a rebuilding target with the information we have in front of us. We could use it as a research recommendation, yet, but not as a target.

Q (Jake Rice) - If we are prepared to accept this production model to estimate B msy for this stock, we will be asked if we can run this model for all stocks?

A (SG) - Not all stock dynamics can be easily fit by production models. If one gets big recruitments from low SSB for example, then cannot get good fits.

A (JN) - The model can work well if 1) management unit is a good match to stock structure; 2) compensatory responses are plastic and work well in the biology and population dynamics of the

species; and 3) immediacy of population response to perturbation. (There was much dispute on that one property.)

Q (Bob O'Boyle) - What does VPA say about the 37,000t?

A - VPA does not say anything about 37,000t, because it is outside the range of the data base.

Comment (Steve) - This is why we like the production model.

Comment (SG) - If the catchability parameter of the production model is off, B msy may be estimated badly. The VPA suggests the maximum should be at least 25,000t (the VPA estimates biomass in the year the production model said the stock was at B msy). So we should use the case as an illustration, and highlight more work is needed to refine estimates. In any scenario the stock is well below B msy, and the USA target (which is not based on msy) of 10,000t is lower than the best biological one.

Summary (Mike Sinclair) - The SSR will present that argument, and discuss the need for an F well below F0.1 in order to get there.

Comment (Russell) - The SSR should highlight that there should be rapid response of biomass, which will pay back to industry for their forbearance with this stock. There is already evidence that the stock has a high likelihood of increasing quickly when SSB is allowed to grow.

Q (Industry) - Can we use the same graph of risk as in haddock document -- probability of rebuilding as function of harvest rate? Then we can use same judgment as in choosing level.

Comment (Steve) - USA document has plot of trajectory to 2,000 at status quo and F0.1, showing slope of catch is higher at lower F.

Comment (Industry) - There is a value in keeping fishery open gets data.

Q (Alan Sinclair) - What was the value of F0.1 used in those projections?

A (Steve) - Two values were used; one is biomass weighted for whole population and the other is for fully-recruited ages. Some transformations are described. F0.1 on total biomass is 0.27.

Comment (Alan Sinclair) - If F msy is 0.33 which is limit, and F0.1 is 0.3, these values are too close to be operationally differentiated, if F msy is a limit reference point.

Discussion followed with lots of detail on all the different Fs which were used in the document.

Comment (SG) - It would be useful in text of SSR to give more stress on status quo F, what it is, what its implications are for biomass increase, for quota, etc. These would be useful benchmarks.

To be Redone

Projection model run with 1997 survey included 1 page presentation of basis for the production model, including key algorithms.

4T-Vn (Nov.-Apr.) Cod (Rapporteur: G. Chouinard)

A. Sinclair presented three papers: the first paper dealt with an examination of natural mortality (M) for the southern Gulf of St. Lawrence cod stock, the second examined biological reference points consistent with the precautionary approach with data from this stock as an example and finally, an update of the fishery and survey information for the stock in 1996.

It was first noted that the management plan for 1997 has just been announced with a continued closure of the fishery but with an allocation of 2,000t for by-catch, sentinel fishery and gear experiments. Another review of this stock will be conducted in January 1998 prior to the announcement of the management decisions for 1998. It was agreed that a stock status report would be produced to provide updated information to clients.

Natural Mortality for Cod in the Southern Gulf of St. Lawrence

The fishery in the southern Gulf of St. Lawrence has been closed since 1 September 1993. Catches, which were in excess of 40,000t prior to the closure have been negligible since (less than 1,500t). The annual groundfish surveys have continued to be conducted and provide the necessary data to calculate estimates of M. The survey of the southern Gulf of St. Lawrence is one of the most reliable of the surveys conducted in Atlantic Canada: it has a low coefficient of variation, there is good correlation between successive year-classes and it covers over 95% of the stock area.

Two classic methods were used to calculate M: catch curve analysis and a regression of Z on F. Both methods assumed that F since September 1993 has been negligible. Varying year-class size will affect the results of a catch curve analysis. This was addressed by analyzing the research vessel (RV) data of year-class estimates at successive ages using a model which estimated different intercepts (i.e. year-class indices) but a common slope (i.e. Z, in this case M). Catch curve requires that year-classes included in the analysis be fully recruited to the survey. A residual analysis of the model with various age range combination suggested that ages 7 to 11 were the most appropriate for the analysis. The regression of Z on F used estimates of Z derived from values of the commercial catch rate and the research vessel series for ages 7-12. An estimate of relative F was calculated as the mean of the ratio of commercial catch at age to the research survey relative abundance for successive years.

The fit of the catch curve model was good and suggested a M of 0.45. The regressions of Z on F produced estimates of M of 0.37 and 0.40 for the commercial catch rate and RV data respectively. The regression was not significant for the latter and confidence intervals were wide for both. However, both analyses suggest that M is in the range of 0.4.

Total mortality estimates for 4-year periods calculated from research survey data suggested that a M of 0.4 is possible since all values in the time-series are significantly above 0.4. The trends in these mortality estimates are consistent with the variation of fishing effort over the time period. Analysis examining the observed age composition of catches and growth rates suggested that a M of 0.4 would not be inconsistent with these data. The latter suggested that M has been higher starting with the 1973 year-class. An ADAPT analysis where M was set at 0.4 on year-classes produced after 1972 indicated that residuals would be better balanced with this assumption.

Several points of clarification were raised. During the discussion, it was noted that fall recruitment to the survey gar does not occur until fish reach age 5-7. It was suggested that a dome shape partial recruitment to the survey could affect the estimates, however, there is no indication of such a pattern for the ages (7-11) used in the analysis in this survey. It was also noted that the break in M does not correspond with a change in research vessel.

Regarding the growth curves, $L\infty$ is often poorly estimates which could affect the estimates of maximum age. The reduction in size at age could also be caused by some other factors such as size-selective fishing. It was also noted that using the growth patterns would suggest a high M for faster growing stocks such as Georges Bank cod.

Preliminary analyses indicated that catch curve analysis of ages 5-7 resulted in mortality estimates which were only one half those of the older age groups. Since ages 5-7 are fully recruited to the RV survey gear, these findings are not fully consistent with the results for the older fish, and will require further investigation.

- It was **recommended** that a formulation of ADAPT which would estimate M in the two periods mentioned above, be attempted. It was also suggested that the catch curve analysis be repeated with ages 5 to 7 in the recent period to determine whether it would suggest a similar value for M.

As a result of the discussion, there were no indications that the analyses presented were deficient. There was agreement that the work was important and needs to be pursued along the lines indicated above. This may also have implications for other stocks be pursued. Finally, it was concluded that this issue needs to be explored and resolved prior to the stock assessment to be conducted in January 1998 for this and potentially other stocks.

Biological Reference Points Relevant to the Precautionary Approach

Recent international agreements which Canada has endorsed require that biological reference points such as biomass levels related to the maximum sustainable yield (MSY) be determined. Currently, reference points are based on yield-per-recruit considerations which are often not relevant to MSY. Using data for 4T-Vn cod, simulations indicated that ignoring the underlying stock-recruit relationship even when it is poorly defined could lead to lower yield. An age-structured production models which combine the notion of yield and SSB per recruit with a

stock-recruit relationship was suggested as a method of determining Bmsy. Analysis of data for four time periods showed that the large changes in growth have not resulted in different F0.1 levels but change the estimate of MSY considerably for the stock. The analysis also examined the effect of changing the age at recruitment on the yield curve as well as illustrating the uncertainty in the estimation of Bmsy.

During the discussion, Bmsy was considered to be a useful reference point. It was also indicated that there are other ways of estimating this reference point that could be examined (e.g. other production models; using sampling to estimate recruits, etc.) and that a greater technical review was needed. It was noted that this is also an issue that needs to be examined before January 1998. A zonal review of the issue was suggested.

Update of the Fishery and Research Survey Information for Southern Gulf of St. Lawrence Cod

The fishery for cod in the southern Gulf of St. Lawrence has been closed since September 1993. In 1996, landings of cod from by-catch in other fisheries, sentinel surveys and mesh selectivity experiments amounted to about 1,100t, a similar level to 1994 and 1995. landings peaked in September and mobile gears (otter trawls and seines) accounted for over half of the landings. Catch at age was calculated from port samples and the sentinel fishery where sampling was very high. Samples from the mesh selectivity experiment were not available in time for the assessment: the catch at age for these landings (225t) will be recalculated at a later date.

Monthly fish condition estimates are about the same level as those seen in 1994 and 1995, however fish appeared to have reached a high condition in July which is earlier than previous years. Annual condition indices do not show a particular trend.

Sentinel surveys showed some increase in catch rates particularly for the adult part of the population particularly in the eastern southern Gulf of St. Lawrence. Catch rates for seiners off northeastern New Brunswick have remained largely unchanged since 1994. Length frequencies showed a mode consistent with the 1993 year-class.

The 1996 research vessel survey indicate that the stock continues to be at low abundance. Survey biomass has increased but primarily because the growth of year-classes present before the fishery closed. The distribution of cod biomass from the survey appears to have changed somewhat in the last few years. A greater proportion of the biomass is found in the eastern area of the southern Gulf. Biomass in that area is above average compared to previous years.

Because of uncertainties in M, no VPA analyses were conducted, but methods of analysis using the survey indices and catches on their own were used. Trends of total mortality and recruitment trends from multiplicative analyses of the research vessel data indicated that recent year-classes are all well below average and total mortality declined substantially after the closure. The 1985-1987 year-classes experienced a total mortality 0.75 greater than previous or subsequent year-classes. Relative F estimates indicate similar trends.

During the discussion, there were no major points of contention with the perceived status of the stock raised. The main points in the discussion focused around the reasons for the change in the relative biomass between the western and eastern area of the southern Gulf. No clear explanation could be identified but there were several suggestions that the cold temperatures may have something to do with it. Further research is required in this area. When discussing the long-term status of the stock, it was suggested that the high levels of the mid-1980s may be anomalous and not attainable in the future. However, it was pointed out that the stock had been exploited heavily since the 1950s and that the levels in the early 1950s were as high or higher than the mid-1980s. It was concluded that the further analyses suggested regarding the estimate of natural mortality and reference points have a high priority and need to be completed prior to the assessment in January 1998.

There was some discussion on the usefulness of producing a Stock Status Report on this stock when the management decisions have just been announced. Concern was expressed that a SSR may be at odds with the recent announcement. It was indicated that the SSR would present the new information gathered in 1996 and that it would be of interest to some of the clients. It was agreed that the SSR would be produced.

4Vn Cod (May-Oct.) (Rapporteur: T. Lambert)

Steve Campana presented a paper on stock structure of cod.

Questions/Remarks

It was noted that some of the 4T "fingerprint" values seemed to be closer to the 3Pn4RS cluster than the main 4T cluster (Figures 2 and 3). This was partially explained by the fact that some of autumn samples (Figure 3) were taken from northern 4T, adjacent to Laurentian Channel and 4S.

Since 4Vn is adjacent to and "downstream" of 4T and further, since 4T and 4Vn cod occupy the same body of water for 7-8 months perhaps it is not surprising that 4Vn fingerprints are very similar to 4T? Otolith elemental "load" is not only a function of ambient water mass characteristics, but is also a function of growth rate.

The speaker was questioned regarding the use of "significant difference". Statistical significance was intended.

Speaker suggestion catch in 4Vn during May should be attributed to 4T rather than 4Vn. There was some discussion on this with the following points raised:

- timing of spring return of 4T to Gulf seems quite variable and perhaps a function of ice cover;
- important issue should be dealt with at separate meeting, plus pros and cons of regional vs zonal initiative discussed;

- 3Pn4RS mixing a much greater problem and should be major focus of this meeting; and
- mixing issue should be dealt with prior to January 1998 at zonal meeting -- high priority stock discrimination results probably not available before late autumn; this needed to be taken into account when planning meeting.

4Vn Status Update

Chairman noted that it was desirable to deal with 4T and 4Vn together and tat since 4T was not being assessed until January 1998, it was probably not necessary that 4Vn be formally assessed at this RAP.

It was noted that additional important data regarding recruitment should be available by then.

Why did Table 1 (annual catch by gear) show catch accumulated over May-Dec rather than revised May to Oct. This is a catch history reflecting management measures as well as exploitation history. Revised unit data are shown as asterisked values.

Should survey be used to tine VPA. There is little else to use and earlier RAPs have concluded that despite variability it is felt that index does reflect stock abundance.

If there is an influx of cod from adjacent areas, should not this be reflected in Table 5 (population numbers)? No; VPA could not show this -- extra fish would be buried in catch at age and could not be distinguished from recruitment.

Figure 11, VPA biomass/RV indices - It was pointed out that 1+ biomass was extremely poor fit. Agreed. VPA not good but primarily done for illustrative purposes and also to get estimate of stock size for weighting tag returns. Also, RV catches very few age 1 fish.

It was suggested that 10,000t threshold line (Figure 12) should be increased to 17,000t of spawning biomass.

Request for VPA residual plots. Done but not available due to demise of computer. Could be redone and supplied for tomorrow.

3PNO,4VWX Halibut (Rapporteur: S. Campana)

Maps generated from ECNASAP data showing the relative distribution and abundance of halibut from RV surveys along the eastern coast of North America indicated that catches in more northerly waters (NF) declined considerably after 1990. There was considerable discussion on the implications of this observation, particularly whether it reflected a shift in distribution outside of the survey area or a generalized decrease in abundance. No consensus was reached. The low numbers of RV sets in 2GH after 1990 was noted, but was not sufficient to explain the observed

effect. The Subcommittee recommended that further research be carried out to determine if the reduced catches reflected an environmentally-influenced shift in distribution or a decrease in abundance. This research should include an examination of the relationship between commercial landings and the stratified RV index within each of the 3NOPs and 4VWX areas. Thus the Subcommittee recommended that NFs stratified RV survey data be integrated into the assessment.

- It was **recommended** that further research be carried out to determine if the reduced catches reflected an environmentally-influenced shift in distribution or a decrease in abundance.

The rationale for treating 4RS halibut as a separate stock was not clear given the continuity of distribution with the 4VWX3NOP stock and the known mobility of this species. Therefore the Subcommittee recommended that the management units for this species be reevaluated. However, even if the east coast is one stock, the distributional and published information is consistent with the view that SW Nova Scotia is an important (or perhaps the only) recruitment area for the species, with a generalized shift in distribution to more northerly waters with age. If true, this would explain the relative stability in abundance of the Scotian Shelf halibut compared to those in NF waters.

The commercial catch rate index for this stock, using catch rather than value as a defining measure of a directed trip, showed promise as an abundance index. However, the use of a single index across the entire stock area may have confounded the interpretation, given that the abundance appears to have declined in NF waters more than on the Scotian Shelf. Therefore, the Subcommittee recommended that the catch rate index be disaggregated between 4VWX and 3NOPs. It was also noted that the introduction of the circle hook in the mid-late 1980s would have made any decline in catch rate less noticeable than would otherwise be the case. A measure of total directed LL effort in the halibut fishery would be useful.

- It was **recommended** that the catch rate index be disaggregated between 4VWX and 3NOPs.

As an abundance index, RV surveys would probably be more appropriate for smaller fish than for larger fish, given the presumed selectivity of the gear. In addition, mortality estimates derived from RV data may include an emigration term as well as a mortality term.

The comparison of LL catch curves between 1960 and the present could provide strong evidence of any net increase in mortality over the time period. However, the comparison was confounded by use of 4VW3P catches in 1960 but only 4VW catches for the recent catches. Given the net movement of larger fish into NF waters, the comparison may have excluded some larger fish from the 1994-96 catch curve. Therefore, the Subcommittee recommended that the comparison be restricted to halibut from the same areas.

- It was **recommended** that the comparison be restricted to halibut from the same areas.

The Subcommittee noted the sensitivity of all of the mortality calculations to the selection of growth model, as well as the importance of accurate age data for any calculations of YPR or F0.1. Since the applicability of the 4RS growth model to 4VWX3NOPs halibut is unknown, the Subcommittee recommended that accurate age data be collected and applied to all future mortality and yield calculations for this stock.

- It was **recommended** that accurate age data be collected and applied to all future mortality and yield calculations for this stock.

4T Plaice (Rapporteur: K. Frank)

Div. 4T American plaice presented by Morin, R.

It is well known that the capture and discarding of undersized plaice has been a longstanding problem in the 4T plaice fishery. Several measures have been adopted to reduce the problem with the most recent being the use of 155 mm square mesh in the mobile gear fishery and temporary area closures when excessive catches of small fish prevail. It was suggested that these changes were having a significant impact on the discarding of small fish but this was not evident from the available data. For example, comparisons of length frequencies from observer and port samples in 1996 revealed substantial differences indicative of continued discarding. It is unclear whether or not discarding is going up or down as a result of these management measures and the question remains - are these regulatory changes improving the discarding situation?

Plaice have been routinely aged from commercial and RV samples in the southern Gulf making it possible to conduct an age structured analysis such as VPA. This was not attempted. Instead the resource status and exploitation history was based on estimates of minimum trawlable biomass and total mortality from surveys, temporal changes in the size/age composition of the stock, and relative F's. It was recommend that a VPA of this stock be attempted and the evaluation begin at age 6 in order to circumvent the discarding of younger ages

Among the benefits of doing so would be provision of information on catchabilities and estimation of fishing mortalities on older age plaice.

The geographic distribution of the plaice fishery has shifted in recent times and is now dominated by landings from units areas 4Tf and 4Tg in the eastern half of the southern Gulf. A sharp decline since 1992 in catches of vessels off the Gaspe coast, in Chaleur Bay and in the Shediac Valley was evident. Further evaluation of these two components is required to determine the reason(s) for this shift in distribution; it would also be useful to calculate the length at age from the two components to examine their growth history

Further to this recommendation it was noted that no regulations associated with the distribution of fishing effort are under consideration and given the differential responses the east and west components have exhibited this could be of immediate concern.

- It was **recommended** that a review of the east/west components in terms of the pattern of catch by month and the timing of the in- and out-migration be undertaken

Several other minor issues were raised including:

Need to know % of observed trips associated with comparisons of length frequencies from observed and port samples

How robust are parameter estimates of length and age distributions to sample size?

What are the reasons for the declining weights and lengths at age? is it due to size-selective fishing, biological factors or what?

Does total mortality of 5+ plaice follow the pattern of fishing effort? Can we say anything definite about the exploitation pattern?

There was some confusion about why the 5+ and 8+ relative F's did not bracket the 30cm+ relative Fs. This may have more to do with labelling of the figure rather than the analysis.

The general conclusion of the subcommittee was that a stock status reported be deferred until further review at the January 1997 meeting.

4T Yellowtail Flounder (Rapporteur: R. Morin)

Gloria Poirier presented an overview of 4T yellowtail. This is the first comprehensive evaluation that has been made of the resource.

Fishery

Following the presentation, the discussion centred on the management measures that are currently in place for 4T yellowtail and the issues that have been raised. G. Chouinard explained that most of the issues have been related to the bait fishery on the Magdalen Islands, where fishers have requested that bait licencing be maintained for the exploitation of yellowtail as bait in the local lobster fishery. A participant asked how bait catches are recorded in 4T. G. Poirier explained the procedures of recording bait catches under Supplementary "B" forms.

The question was asked whether there has been any recent changes in fishing effort? Industry participants at the meeting commented that effort is low on yellowtail and that there is no significant directed effort on the resource at present. They did not feel that effort would increase.

Resource

It was noted that comparisons of the length-frequencies of commercial and research survey catches of yellowtail resemble the case of 4T American plaice, a stock with a history of discarding in the commercial fishery. The modal lengths of yellowtail are similar in commercial and survey data, but the ascending portion of the length distribution is more steep among the commercial catches, suggesting that discarding of yellowtail less than 30cm may occur at sea.

Concerning the research survey index, it was asked what effect the day-night conversion factor would have on the trend in stock abundance if it was removed. G. Poirier explained that the conversion factor was applied to catch data since 1985, the year that nighttime trawling began in the 4T groundfish surveys. Removing the factor would increase the abundance index for yellowtail in the 1985-1996 period.

On the basis of the composite mapping of yellowtail catches in the groundfish surveys (Figure 11 of the WP), G. Chouinard commented that several stock units may be surmised within 4T. The question was raised whether yellowtail distribution is depth-related. It appears from the maps of yellowtail catches in research surveys that the survey encompasses all or most of the shoreward distribution of yellowtail, unlike the situation for winter flounder. In conclusion, the committee agreed that for 4T yellowtail, (1) the survey is relatively good; (2) the survey should track local abundance trends of yellowtail in 4T.

The discussion raised several questions concerning the life cycle of yellowtail in 4T. These related mostly to the movements of yellowtail and their seasonal distribution in the Gulf. It was asked if there is evidence of overwintering in estuaries. The response was negative, but it seems unlikely that yellowtail leave the Gulf in winter.

4T Winter Flounder (Rapporteur: L. Currie)

Rod Morin presented the assessment of this management unit.

Winter flounder are found at 18 fathoms or less; can only get a purely directed winter flounder fishery if you move inshore.

Effort on winter flounder has declined in the Northumberland Strait and St. Georges Bay since the mid-70s, due to restrictions on rockhopper gear.

The winter flounder fishery is not just a mobile gear fishery. From Table 1, the trawl component has decreased, but the gillnet component has increased (which is composed mainly of tangle nets). The percentage of winter flounder taken with tangle nets has increased since the mid-80s. Some sampling of tangle nets has indicated larger fish being caught in herring spawning areas. Many closures last year in the tangle net fishery, due to cod and hake catches.

Are seals a question, especially in inshore areas? - the diet study to be undertaken on seals this year should answer this question.

Where do they spawn? - winter flounder overwinter in estuaries and spawn in nearby coastal areas; they are very localized stocks. The overall RV survey shows a variable picture of the winter flounder population; with some areas increasing in abundance, and other areas decreasing. Examining other years, there also seems to be a year/depth interaction. We should try to figure out what proportions of the winter flounder population are in the different areas; but the RV survey cannot sample the inshore areas very well. It would be better to have additional surveys, closer to shore; perhaps the industry would undertake this.

There is a need for logbooks; the landings are not fully covered as winter flounder landings are reported as 'flounder' or 'plaice' , and the coverage on the Supplementary Bs is not consistent. We need to look at the RV data to see if the average weight has decreased. The mean numbers are not smaller, but the trawlable biomass had decreased.

Is the minimum size limit appropriate? - 25 cm appears fine for protecting spawning fish and complies with the 50% target. Should the target be reconsidered? - keep in mind that these are mixed stock fisheries, including cod and hake. Suggest examining observer length frequencies also.

- It was **recommended** to look into mesh size - is it appropriate?

Since 1992, the catches have decreased from 2000 tonnes to less than 1000 t, but the effort has also decreased, because of decreased effort of other fisheries. The TAC now in effect is a tool to minimize any redirection of fishing effort from other fisheries. 1996 was the first time a quota (1000 tonnes) was placed on winter flounder, as an attempt to minimize the re-direction of effort from other fisheries.

Suggest hold the line on the TAC and look at distributing the effort geographically.
If the issue is local depletion, it should be dealt with at the local level, not at this level.
Better information is needed on local abundances, in shallow waters and estuaries, where the RV survey does not sample adequately; we should not use the RV survey as the general average for this stock.

- It was **recommended** we need the catches associated with the local areas; identify these areas, if the populations is to be broken up by local geographical areas we need surveys specific for these areas and have to get industry/management involved.

The effort level of 1,000t should remain to allow growth.

The bottom line is - the present level of fishing is not decreasing the resource, but there may be trends in local areas. Current level of harvest is not detrimental to the stock., as a whole, but there exists a vulnerability of local depletion.

4T White Hake (Rapporteur: G. Poirier)

Doug Swain presented the assessment of this management unit.

There was discussion on the pattern in landings and survey indices. the landings were at a steady level (with the exception of large landings from 1979-1984) from 1961 to 1992, and then all of a sudden dropped in 1993. Similarly, the research vessel abundance index drops in 1993. The spatial distribution of white hake in the 4T survey has been contracting over a period of several years, until in 1996 there were very few strata in which they were found. The recruitment index from the survey (numbers at age 3) was uniform until 1993 when it suddenly dropped. The sharp decline in the survey index in 1993 appears to be too large to be accounted for by reported catches. There were several comments on the fishery and surveys:

- Effort directed to groundfish in 4T peaked in 1992.

- Perhaps the hake are moving out of our survey area (but it was mentioned that there is no evidence of this from other surveys in adjoining areas). A fisher questioned whether perhaps a tagging program would give useful information.

- In the early to mid 1980s, white hake were widespread in the southern Gulf, but fishing on spawning grounds in the Northumberland Strait may have eliminated some spawning components, which may have led to the current restricted distribution of white hake in the Gulf.

- The low variances of the survey mean number/tow in the recent years were questioned. It was felt that strata 403 and 433 have been the driving influence in the surveys for white hake in the last few years, and that now, because almost all of the hake are found in these strata, we have a large number of strata with no catch of hake, and a very few strata with relatively large catches of hake, resulting in low variances of the estimate of the mean.

- It was pointed out that the survey abundance trends for the strait and channel component are not the same, and there several crossovers of the trend lines, perhaps reflecting an exchange of fish between these components.

- The survey takes place in September, before white hake start their migration out of the Gulf of St. Lawrence.

- There have been rumours of a black market for white hake, and unreported catches of hake off the coast of P.E.I.; it was asked how much unreported catch would be necessary to account for what we see (no one knew). There was speculation that the closure has not been effective. The fishers at the meeting felt that there may be some illegal landing of white hake, but did not feel there would be a lot. They mentioned the lack of enforcement, stating that there is no deterrent to illegal activities.

A participant mentioned that fecundity information would be useful.

A participant in the sentinel fishery program in St Georges Bay commented that catch rates in 1996 were much higher than seen recently, and resembled those from the late 1980's. Many large hake were caught. It was noted that the groundfish survey is very consistent with what the fishers have been telling the scientists: hake now exists only in the eastern Gulf; the sentinel surveys in St. Georges Bay show good catch rates, and this is the only inshore area with relatively high catch rates in the RV survey in 1996.

It was noted that there was a contraction of age groups in the landings, with not many old fish being caught in 1996. The survey results also indicate a contraction of age classes. Weights at age have been reasonably constant. It was asked whether the size composition of catches in the sentinel surveys is consistent with the 'truncated' age distribution in the groundfish survey.

It was verified that the in comparative experiment in 1988, no significant difference in day and night catches of white hake were found. Some fishers stated, however, that they don't expect to catch hake in night sets, while one fisher suggested that there is fishing at night by mobile gears (implying that catch rates would be higher in the nighttime then in the daytime). One fisher said that smaller hake may be caught at night because larger hake tend to move up off the bottom.

It was explained that the earliest year used in the ADAPT run with the strait component is 1985 because of difficulty in splitting the 4T landings into strait and channel components for earlier years. In all years, landings in unit area 4Tf are taken from both channel and strait components of the stock, and cannot be easily separated into the two.

There was some discussion about the ADAPT results. The model has a difficult time with the abrupt change in the research vessel index from 1992 to 1993, smoothing out the change over several years. The strong year effects in the residuals were pointed out, but there was general consensus that the retrospective pattern was not too bad. The q's were high on the young ages and smaller on older ages, indicating the older aged hake were not as available to the survey, though the difference in q between younger and older hake was generally small. There was some discussion about recruitment - has it been in a monotonic decline since 1988?; has there been a recruitment collapse? A stock recruitment plot would be appreciated.

It was mentioned that whether ADAPT is run on the strait component or 4T as a whole, the results are similar. It was suggested that ages 1 and 2 could be included in the ADAPT runs.

The large total mortalities (Z) calculated from the research vessel surveys are difficult to understand given that reported landings have been very low in recent years. Suggestions were made about the level of biomass on the surveys being so depressed that any amount of fishing would result in relatively high Fs.

There was general belief that the abundance is low, even if the abrupt decline cannot entirely be explained. The ADAPT results raise questions that could not be answered, but it was felt that the

biomass output from the ADAPT run is useful and reasonable even if the fishing mortality pattern and trends in recruitment are suspect.

The 500 tonne allowable catch of white hake in 4T for 1997 was felt to be too high given the extremely depressed state of the stock.

Concluding Discussion

Upon completion of the SSRs there was a general discussion on the planning that is required prior to the January 1998 meeting on the cod stocks which have or had been under moratoria. It was considered essential that a common framework be adopted for the assessment of these cod management units and that prior consultation/discussion was needed amongst those responsible for the respective assessments.

- It was **recommended** that Jake Rice take the lead in ensuring that a common framework for the January 1998 cod assessment be developed.

A second issue was follow-up on the analysis of limit and target reference points, with particular reference to the paper presented by Alan Sinclair. Two points were stressed. First, the issue is a national one requiring participation by all regions. A natural workshop was considered the best option. Second, some preparatory work on various options is required. Within the Maritimes Region this work can best be done under the reviews of the Fisheries Management Studies Working Group (Chair: Ralph Halliday).

- It was **recommended** that Jake Rice either take the lead (or delegate to one of the DFO regions) in holding a national workshop on limit and target reference points.

A third issue discussed was the pros and cons of reviewing the southern Gulf groundfish and pelagic management units in late January of each year. The major benefit is that the advice for the coming fishing year includes the results of the September RV survey and thus "updates" would not be required. The negative aspect is the lack of catch statistics for the fourth quarter of the calendar year and the difficulty in accessing the catch/effort statistics during December. In spite of these difficulties, it was considered a positive change which can be evaluated for the relative strengths and weaknesses this coming January.

In closing the meeting, the Chair thanked all the participants for their active participation.

Appendix 1.

Agenda
RAP Marine Fisheries Subcommittee Meeting
21-25 April 1997

Miramichi Boardroom
Gulf Fisheries Centre
Moncton, New Brunswick

Time	21 April Monday	22 April Tuesday	23 April Wednesday	24 April Thursday	25 April Friday
08:30-09:00		5Z Had (Can)	5Z Yellow (US)	Halibut	4T White Hake
09:00-09:30	Travel	5Z Had (Can)	5Z Yellow (US)	Halibut	4T White Hake
09:30-10:00		5Z Had (Can)	5Z Yellow (US)	4T Plaice	4T White Hake
10:00-10:05	Introduction	COFFEE	COFFEE	COFFEE	COFFEE
10:05-11:00	Env. Overview	5Z Had (Can)	4T Cod	4T Plaice	4T White Hake
11:00-11:30	5Z Cod (Can)	5Z Had (Can)	4T Cod	4T Plaice	4T White Hake
12:00-13:00	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH
13:00-13:30	5Z Cod (Can)	5Z Had (US)	4T Cod	4T Yellowtail	Reruns and SSRs
13:30-14:00	5Z Cod (Can)	5Z Had (US)	4T Cod	4T Yellowtail	Reruns and SSRs
14:00-14:30	5Z Cod (US)	5Z Had (US)	4T Cod	4T Yellowtail	Reruns and SSRs
14:30-15:00	5Z Cod (US)	5Z Had (US)	4Vn Cod	4T Yellowtail	Reruns and SSRs
15:00-15:30	COFFEE	COFFEE	COFFEE	COFFEE	Reruns and SSRs
15:30-16:00	5Z Cod (US)	Discussion	4Vn Cod	4T Winter Fl	Reruns and SSRs
16:00-16:30	5Z Cod (US)	Discussion	4Vn Cod	4T Winter Fl	
16:30-17:00	5Z Cod (US)	5Z Yellow (Can)	4Vn Cod	4T Winter Fl	Travel
17:00-17:30	Discussion	5Z Yellow (Can)	Halibut	4T Winter Fl	
17:30-18:00	Discussion	5Z Yellow (Can)	Halibut	4VW Capelin	
18:00-21:00				RAP Steering Committee Mtg.	

Appendix 2. List of Participants.

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Appendix 3. List of Documents (in order of presentation).

Drinkwater, K. Summary of Environmental Conditions off Eastern Canada in 1996.

Page, F., and R. Losier. Overview of 1997 Hydrographic Sampling Effort and Near-Bottom Water Temperature and Salinity Conditions During the Canadian Research Vessel Groundfish Surveys Conducted During the Spring on the Eastern Scotian Shelf (4VsW) and Georges Bank (5Z).

Gavaris, S. and L. Van Eeckhaute. Assessment of Haddock on Eastern Georges Bank.

Gavaris, S. Propagation of Statistical Bias in Assessment Results.

Brown, R. USA Assessment of the Georges Bank Haddock Stock, 1997.

Hunt, J.J., and M-I. Buzeta. Population Status of Georges Bank Cod in Unit Areas 5Zj,m for 1978-96.

O'Brien, L., and R.K. Mayo. Assessment of Georges Bank Cod Stock for 1997.

Cadrin, S.X. Stock Assessment of Georges Bank Yellowtail Flounder.

Neilson, J.D., S.X. Cadrin, S. Gavaris, and J. Hunt. 1997 Assessment of Georges Bank (5Zjmnh) Yellowtail Flounder (*Limanda ferruginea*).

Campana, S.E., T. Lambert, G. Chouinard, M. Hanson, A. Fréchet, and J. Brattey. The Stock Identity of 4Vn Cod Based on an Analysis of Otolith Elemental Fingerprints.

Mohn, R., T.C. Lambert, S. Wilson, and G.A.P. Black. Update of the Status of 4Vn Cod: 1996.

Zwanenburg, K.C.T., G. Black, P. Fanning, R. Branton, M. Showell, and S. Wilson. Atlantic Halibut (*Hippoglossus hippoglossus*) on the Scotain Shelf and Southern Grand Banks: Evaluation of Resource Status.

Gilbert, D. Conditions Océanographiques dans le Golfe du Saint-Laurent en 1996.

Sinclair, A. Biological Reference Points Relevant to a Preacutionary Approach to Fisheries Management: An Example for Southern Gulf Cod.

Sinclair, A. Natural Mortality of Cod in the Southern Gulf of St. Lawrence.

Sinclair, A., G. Chouinard, and L. Currie. Update of Fishery and Research Survey Information on the Southern Gulf of St. Lawrence Cod Stock, April 1997.

Swain, D. Changes in Cod Distribution in the Southern Gulf of St. Lawrence: Effects of Environmental Change or Change in Environmental Preferences?

Swain, D.P., and G.A. Poirier. Distributions of Atlantic Cod and American Plaice During the September 1996 Survey of the Southern Gulf of St. Lawrence and Their Relation to Historical Patterns.

Morin, R., G.A. Chouinard, I. Forest-Gallant, and G.A. Poirier. Assessment of NAFO Division 4T American Plaice in 1996.

Morin, R., and I. Forest-Gallant. Assessment of NAFO Division 4T Winter Flounder in 1996.

Morin, R. Preliminary Results on Groundfish Catches in the 1996 Calanus Survey of the Magdalen Islands.

Poirier, G., R. Morin, and D. Swain. The Status of Yellowtail Flounder in NAFO Division 4T in 1996.

Hurlbut, T., D. Swain, G. Poirier, and G. Chouinard. The Status of White Hake (*Urophycis tenuis*, Mitchill) in the Southern Gulf of St. Lawrence (NAFO Division 4T) in 1996.

Appendix 4.

PROCEEDINGS OF THE COD HADDOCK AND FLATFISH ASSESSMENT WORKING GROUP IN SPRING 1997

Chair: Steve Campana

Meetings of the Cod, Haddock and Flatfish Assessment Working Group were held on the following dates: February 19, March 11, March 25, April 9, and April 17, 1997. The following issues were discussed in the WG:

4Vn Cod

The distribution of 4Vn cod in the 1996 summer RV survey was roughly comparable to that observed between 1993-95, although with some tendency to be less widely dispersed throughout the region. The 1996 abundance index continues to be extremely low, although the numbers of age 1 and 2 cod were somewhat higher than in previous years.

Percentile distributions of summer RV data showed that the age range of 4Vn cod has not become as constrained as that of 4VsW cod in recent years. However, the weight data has, due either to systematic removal of the larger fish or a decline in growth rate since the 1980's. The time series of condition factor for 4Vn cod is generally similar to that of 4VsW, although 1995-96 values in 4Vn have increased to near the long-term mean. The fact that the trends for unrecruited (30-34 cm) and recruited (60-64 cm) cod are similar suggests that the factors influencing condition factor are fishery- independent.

Length frequencies aggregated by 5-yr blocks showed loss of larger fish in 1990-94 compared to 1985-89, but not of the magnitude present in 4VsW cod. Using an age-based growth curve, z values were estimated from the blocked length frequency data. Total mortality remained roughly constant between 1970 - present at around z=0.76, despite the closure of the fishery in 1993. The length- based approach provided only a coarse approximation of the z values estimated from ages in a comparison of RV z's, LVPA z's, and ADAPT F's of 4VsW cod. There, the LVPA z greatly smoothed and underestimated the mortality rates apparent from both ADAPT and the RV ages, indicating that the former is a relatively insensitive indicator of mortality rate. The closer correspondence between RV z and LVPA z in 4Vn may be attributable to immigration of older fish from other stocks. Since LVPA is being used with increasing frequency in stocks where age data are absent, the WG **recommends** that its utility (and deficiencies) as an assessment tool be examined in considerably more detail.

A comparison of the abundance of age 1 and 2 cod in the 4Vn inshore survey with the same year-classes at age 2 and 3 in the summer RV survey showed good correspondence for the 1990-1994 year-classes. Since the inshore age 1 index indicates an abundant 1995 year-class, a comparison with the age 2 and 3 Needler values in 1997 and 1998 will provide a good test of the value of the inshore survey as a recruitment indicator.

Distributional maps of cod in the 1994 and 1995 Sept Gulf surveys showed similar patterns and catch rates in 4Vn in both years. A 1996 survey was not conducted.

Catch rates in the Sept 1996 sentinel survey were 21% lower than in the previous year and 30% less than in 1994. The July 1995 and 1996 sentinel survey catch rates showed a comparable decline, but its mean catch rate was much lower due to a seasonal effect. Length frequencies in the July and Sept sentinel surveys were comparable, and skewed to larger fish than the Needler survey.

While the benefits of a VPA to our understanding of 4Vn cod population dynamics are obvious, there was considerable discussion on the appropriateness of a VPA for a stock which appears to show extensive mixing with adjacent stocks. This issue was the subject of the Report of the 4Vn Cod Working Group (DFO Res. Doc. 95/16). To better understand whether a VPA is appropriate, correlations of RV numbers at age along year-classes were compared in 4T, 4Vn and 4VsW to assess how well the cohorts could be tracked from year to year within each stock area. The results were very sensitive to the use of normalized vs unnormalized data, but suggested that the same cohorts could be tracked in both 4Vn and 4VsW; cohorts were less well tracked in 4T. The correlation between 4Vn and 4VsW is consistent either with the presence of a resident 4Vn stock influenced by large-scale recruitment factors or significant intermixing between 4Vn and 4VsW cod. Therefore the WG could not agree whether or not a VPA for 4Vn cod was warranted. Nevertheless, a VPA (using only May-Oct catches) was presented, suggesting that biomass and F in 4Vn have paralleled those in 4VsW, with the latter being larger than the former by a factor of 5-6. While F dropped to near-zero levels after the fishery was closed, biomass estimated from the VPA remained at record- low levels after 1990. While the fit of the VPA model was relatively poor, the correspondence with the summer RV abundance index was reasonable. Stock recruit relationships, bootstrapped projections and risk analysis "bird droppings" for 4Vn cod, based on recent mean recruitment, all indicated that recent recruitment and the prospects for stock recovery were poor. The WG was impressed by the potential value of the bootstrapped risk analysis plots, and agreed that they were more informative than the probability line plots used elsewhere. The WG **recommends** that the type of risk analysis plots presented for 4Vn cod be presented routinely for other stocks, and that further work be carried out to incorporate additional major sources of uncertainty such as stock mixing, variation in M, etc.

An examination of historic tagging data in 4Vn and 4VsW was carried out using tag recoveries weighted by estimated population size (eg- a dilution factor). The results reinforced current thoughts on the overwhelming predominance of 4T fish in the 4Vn region between Jan-Apr, and the presence of a 4Vn resident stock in the summer.

Migration timing of 4T cod through 4Vn was inferred on the basis of increased catch rates and fluctuations in mean length, although the WG did not reach a consensus on the value of these measures. If these are indeed migration indicators, the spring timing results suggest that substantial numbers of 4T cod were present in 4Vn in May of both 1995 and 1996, despite the fact that migration has been assumed to have been completed in April.

An analysis of otolith elemental fingerprints indicated that there were significant and substantial differences among spring spawning aggregations of the 3Pn4RS, 3Ps, 4Vs and 4T cod stocks. The elemental fingerprints of the fall, pre-migration stocks were very similar to those of the spring, with one exception: 4Vn. While the elemental fingerprints of the fall-collected 4Vn cod were stock- specific, the fingerprints of cod in near-spawning condition collected in Sydney Bight in May 1996 were virtually identical to those of 4T, indicating that these were actually 4T spawners. Thus substantial numbers of 4T cod were present within the 4Vn stock area at a time when only resident cod are assumed to be present. These results are consistent with the migration timing results for 1995 based on the sentinel survey. The persistence of 4T cod in the 4Vn region in May is not consistent with a late departure of ice, since ice cover in both 1995 and 1996 was relatively light. Therefore, the WG **recommends** that further work be carried out on defining the month in which 4T cod have departed the 4Vn stock area, and if necessary, redefine the stock assessment unit so as to exclude the months of substantial spring mixing.

To this point, there is a systematic difference between the age estimates of the primary and secondary ager, due apparently to confusion over the expected diameter of the first annulus. The WG **recommends** that this issue be resolved through measurements of young of the year otoliths, and that the age of the presumed YOY fish from the fall collection (8-11 cm) be confirmed through otolith daily growth increment counts.

Halibut

Based on published tagging data, the current stock management area may or may not be appropriate. Recent tagging efforts have not been analyzed, but are too recent to be informative. Stock structure could not be discerned from ichthyoplankton surveys, since neither the SSIP nor the FEP ichthyoplankton surveys reported the capture of more than a handful of halibut eggs and larvae. Analysis of the large-scale ECNASAP database indicates that halibut distribution is largely contiguous along the shelf edge from Georges Bank to Labrador, including the northern Gulf, with no apparent reason why the northern Gulf halibut are being assessed as a separate stock. The WG **recommends** that the issue of stock structure be pursued.

Landings since the 1800's were tabled, as were several survey indices. The 4VW sentinel survey reported good catches of halibut (80-100), suggesting that it shows promise as an indicator of abundance. The temperature at capture was similar to that of haddock (3-60). Relatively few halibut were caught in the 4Vn sentinel survey. The 1995 and 1996 ITQ surveys in 4X also caught halibut, primarily in the inshore region, but since these surveys were made with OT gear (rather than the longlines used in 4VW), the catch rates and size compositions were not easily compared with those of the other sentinel surveys. Sizes in 4X were much smaller than in 4VW and 4Vn. For future assessments, the WG **recommends** that the relative abundance and length frequency from FSRS logs be analyzed.

Analysis of the 1982-88 redfish surveys along the slope edge of the Scotian Shelf indicated that the catch rates of halibut were higher at depths < 200 fm than at greater depths. A comparison of the size composition in the two depth strata demonstrated that larger fish (> 60 cm) were caught in shallow and deep waters, but that smaller fish were absent in the deeper waters. Spring and

fall redfish surveys showed the same pattern of size segregation by depth, although the catch rates in the spring survey were about twice as high as those in the fall.

In keeping with the redfish survey results, a depth-stratified analysis of the summer RV data indicated that smaller halibut tended to be found only in shallow waters. Further analysis of the distributional data with ACON movies demonstrated that much of the size-related shift to deeper waters was accompanied by a generalized shift from 4X to 4VW, suggesting that there might be a slow migration to the northeast with age. Virtually no halibut < 20 cm long were captured in the summer RV surveys, despite the fact that settlement is purported to occur at about 5 cm. While the apparent absence of these younger fish may reflect settlement in areas other than on the Scotian Shelf, another possibility is that the younger halibut are being systematically misidentified as other flatfish species; the WG **recommends** that the possibility of misidentification be ruled out in a directed study.

Comparison of abundance trends among the summer, spring, and fall RV, as well as the spring 4VW RV, showed reasonable coherence among all 4 indices. Unstratified abundance indices from 5Z, 3NOPs and subarea 2,3M also showed similar trends, although the Grand Banks index has declined considerably more since 1980 than have the 4VW indices. All recent indices showed low levels of abundance. There was no consistent difference in catch rates among the sexes. A stratified index of halibut abundance in the 3NOPs area would be very useful, but was not available to the WG. The WG **recommends** that the stratified data be made available by NF. The WG also **recommends** that a single combined RV index be developed based on standardization among the existing stratified RV indices.

A potentially valuable index of halibut abundance was derived from an analysis of by-catch from the IOP-observed silver hake fishery. While the amount of by-catch was low on a per-trip basis, the number of observed sets and the total by-catch of halibut was high, lending credibility to this index. Catch rates were highest in the early spring, declining through the year as the fishery moved shoreward. Catch rates across the entire silver hake fishery increased gradually between 1977-93, at which point the introduction of separator grates greatly reduced catch rates. The WG noted the discrepancy between the increasing trend of this index and the decreasing trend evident in the RV indices. Therefore, the two sets of indices were made more comparable by restricting them to common areas and months. However, the June-July and Mar-Apr IOP indices showed different trends since 1985, and neither was closely correlated with the summer RV abundance index using only the slope edge strata. Therefore, the WG was not able to conclude which, if either, most closely reflected halibut abundance, especially since the RV and the IOP indices both have relatively high variances associated with them.

IOP-observed longline catch rates were also considered as indices of halibut abundance, using both halibut-directed and cod/white hake-directed sets in 3NO. The two indices showed relatively constant catch rates since 1994, but were quite different prior to that year. Since the declining catch rates of the halibut-directed sets may have been influenced by the entry of inexperienced fishermen into the fishery, the WG was unsure how to interpret these time series. However, the correspondence between the halibut-directed catch rates and the unstratified

3NOPs RV survey index was quite good, suggesting that the relative abundance in the area has indeed decreased.

Potential length modes were apparent in the RV length frequency pooled across years, but year-to- year length frequencies showed considerable variation, as did multi-year aggregations at several levels. Therefore, the WG was not convinced that the modes could be used to infer age. Rather, published age data from 3Pn4RS were used to develop a growth curve which was then used to convert length frequency to age frequency. Published growth curves on Nfld halibut suggested more rapid growth than in the Gulf, but the basis for the Nfld ages was not clear. Since little work on the age and growth of Atlantic halibut has been done, and since none of the published ages have been validated, the WG **recommends** that an ageing technique and growth curve for 3NOPs4VWX halibut be prepared and validated. The WG further **recommends** that historic tagging studies associated with length at tagging and recapture be analyzed to provide estimates of growth rate.

Using a growth curve based on unvalidated 3Pn4RS ages, five-yr blocks of summer RV length frequencies were converted to age frequencies and compared among time periods (length frequencies from the 1995-96 sentinel surveys were too sporadic to be useful for this purpose). No major shift in age composition was apparent between 1970 and the present. Calculations of z derived from the same age frequency data suggested that z has remained relatively constant at around 0.35 for the entire time period. However, since these calculations are sensitive to the growth data which are used, and since the published 3Pn4RS growth rates are somewhat lower than those published for NF, the derived z values may be underestimates.

Length frequencies of historic commercial OT samples (from the 1960's) were reasonably comparable to those of the current summer RV. However, commercial LL samples from 1960 included significantly more larger fish than the mean of 1994-96 commercial LL samples, suggesting that there has been a loss of larger fish over the intervening period. z values calculated using the unvalidated 3Pn4RS age data and 1960 commercial LL samples, produced estimates of z which were 2-3 times lower than comparable LL samples from 1994-96, despite the fact that the comparison was restricted to the same age range. While the z estimate for the current samples was about 0.70, this value is very sensitive to the growth model used, and could change markedly with the introduction of a different growth model.

Previous halibut assessments have been based almost exclusively on commercial CPUE, but were confounded by a definition using landed value rather than catch or target species. Using only halibut-directed trips based on catch, commercial CPUE has declined since 1988.

Environmental Overview

An overview of 1996 environmental conditions relative to previous years reported that bottom waters in 4VW are still cool compared to the long-term mean, but that there is some suggestion of warming in the past 1-2 years. Ice coverage in the Gulf of St. Lawrence was less in 1996 than in 1995, and considerably less than the long-term mean. This latter observation may be of significance to the interpretation of the timing of the return migration of 4T cod through 4Vn;

given the evidence of 4T cod being in 4Vn in May in both 1995 and 1996 (described earlier), and in light of the reduced ice coverage in those years, the May presence of 4T cod in 4Vn is either not anomalous or is not due to the persistence of the ice cover.

Appendix 5. Ad -Hoc Communications Working Group

Attendees: Day 1: R. O'Boyle (chair), F. D'Entremont, C. D'Entremont, E. Walters
Day 2: R. O'Boyle (chair), D. Boyd, C. Burns, F. Hennessey

The purpose of the working group was to investigate, in an informal way, whether or not the current products of the RAP meetings, the Stock Status Reports in particular, are considered useful to DFO client. The working group held two meetings to maximize the participation of industry at the RAP meeting. The first day involved members from Southwest Nova Scotia while the second day involved members from the Gulf. The meetings were short, being held over lunch.

Day 1 (SWNS Comments)

It was generally felt by the group that the Stock Status Reports (SSR) were good for people, like themselves, who are familiar with RAP and its discussions. However, there was consensus that the SSRs are not generally useful to the average fishermen. They are far too detailed, long and technical for them. The level of jargon is quite high and dissuades general consumption.

Discussion then focused on what to do about this. The SSR could be modified to add a Summary or Synopsis section. However, this would just make the document bigger, an undesirable feature. As well, as the SSR is a nationally defined document, it would be difficult to invoke this change. The group agreed that the SSR could remain as is.

The group then focused on what alternates should be explored. What is desired is a one pager including a fish picture at the top, then bullets on the status of the stock (fishery down, recruitment up, biomass down, etc.), followed by a biomass and recruitment plot. This should be very basic and not show too many lines i.e. survey and VPA together, biomass and recruitment together. The one pager would finish with where to get more information. These one pagers would be compiled by the RAP Co-ordinator (O'Boyle) from the information in the SSR when this is produced.

How to distribute these documents was also discussed. It was suggested that at the beginning of the year, when the license renewals are sent out, that information (in layman's language) on RAP and where to get the SSRs, research documents, one pagers, proceedings, etc. be included. This is free advertising.

The one pagers would be sent to the local newspapers on an on-going basis. It was noted that DFO already has a backgrounder series that could be used for this.

Finally, the Communications Secretariat has the Fax-on-Demand service that will eventually allow immediate distribution of the SSRs and backgrounders.

Bob O'Boyle promised to follow up on these issues and in particular move towards early implementation of the backgrounder idea.

Day 2 (Gulf Comments)

The group generally felt that communication was better than what it used to be. However, terminology and vocabulary, particularly at the meetings, was a problem. They acknowledged that we need to create opportunities for dialogue between scientists and fishermen. The problem was how to do this. The RAP meetings are fora for highly technical discussions, and while useful, don't generally provide that opportunity.

There was a felling of a credibility gap that can only be bridged by scientists and fishermen meeting half-way. This brought discussion into activities at sea, and not in meetings - joint science/industry surveys. During this discussion, it was mentioned that there were some in the industry that considered that the setup of the gear on the DFO research vessels was faulty. This was due to the difference in catch rates observed in the same area by these vessels as compared to fishing vessels. It was replied that the design of the science surveys may the basis for this observation, but this did not address the concern. It did however raise the issue of where the DFO surveys fish, which is a standing problem from the industry's point of view.

Solutions to these problems were considered. The Sentinel Surveys on the Scotian Shelf use a two phase design. The first phase is a stratified-random design as defined by Science. The second phase is fishing fully under the control of the participating vessels. This two phase approach has proved useful in comparing what the scientists and fishermen are saying about the resource. It was asked whether or not the DFO surveys could adopt the same approach i.e. phase one as per current practice and phase two, fishing directed by an industry-chosen skipper. This is an intriguing idea that should be investigated further. There are obviously budget considerations that need to be resolved.

Bob O'Boyle promised to follow up on these issues.